

High Resolution X-ray Measurements Following Charge Exchange with Atomic H: Data for a New Observational Window on Diffuse Astrophysical Sources

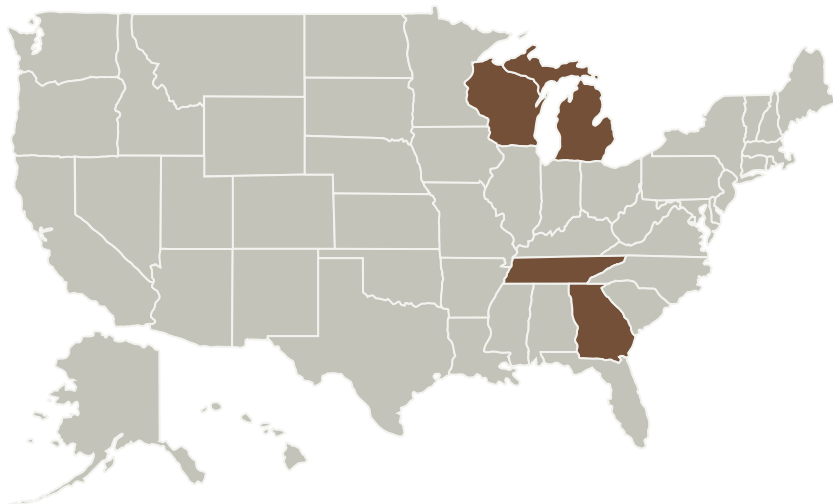
Completed Technology Project (2014 - 2017)



Project Introduction

It is rapidly being realized that many X-ray astronomical investigations are being affected in one way or another by charge exchange emission. Metal abundance measurements in supernova remnants and in outflows from star-forming galaxies need to be corrected for this additional process, and all X-ray observations of low surface brightness objects, such as the outskirts of clusters, galactic halos, the intergalactic medium, and plasma emission from hot interstellar gas are seriously compromised by a highly variable and largely unpredictable foreground from the exchange of solar wind ions on interstellar neutrals within the Solar system. At the same time, charge exchange provides a new sensitivity to mixing at interfaces between hot and cold gas, including direct measurements of relative velocities. The new generation of facilities with microcalorimeter detectors, starting with Astro-H in 2015, will provide the energy resolution and throughput for extended sources required to take advantage of this process. But analysis requires accurate partial cross sections for the production of individual lines, and even the most sophisticated of current charge exchange models do not do this with adequate precision. We propose an inexpensive modification of the Wisconsin high-throughput XQC microcalorimeter instrument so that it can be used on the merged beam facility at Oak Ridge to make direct measurement of lines of interest from collisions between an assortment of heavy ions with neutral atomic hydrogen. In this beam-beam system, the entire range of astrophysically interesting relative velocities can be investigated. We will work closely with modelers to use these results to tune their models to give accurate results for additional ions.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

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Organizations Performing Work	Role	Type	Location
Oak Ridge National Laboratory(ORNL)	Supporting Organization	R&D Center	Oak Ridge, Tennessee
UT-Battelle, LLC	Supporting Organization	Industry	Oak Ridge, Tennessee

Primary U.S. Work Locations	
Georgia	Michigan
Tennessee	Wisconsin

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

Charles C Havener

Co-Investigators:

Phillip C Stancil
Dallas W Wulf
Dan Mccammon
David Seely

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.3 In-Situ Instruments and Sensors
 - └ TX08.3.1 Field and Particle Detectors

Target Destination

Outside the Solar System